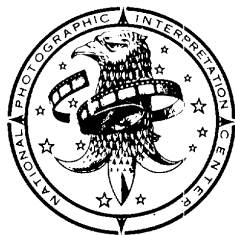


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RCA-03/0037/69

Basic Imagery Interpretation Report



**NATIONAL
PHOTOGRAPHIC
INTERPRETATION
CENTER**

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**KHUTOR ESV TRACKING STATION A
(KHUTOR ESV TRACKING FACILITY
AND KRUG FACILITY 2)**

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DEPLOYED COMM/ELEC/RADAR FACILITIES

USSR

JULY 1969

COPY NO 113

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RCA-03/0037/69

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INSTALLATION OR ACTIVITY NAME Khutor ESV Tracking Station A		COUNTRY UR
UTM COORDINATES NA	GEOGRAPHIC COORDINATES 53-06-05N 158-24-40E	
MAP REFERENCE ACIC. US Air Target Chart 200, Sheet M0194-17HL, 4th ed, Apr 65, scale 1:200,000 (SECRET)		
LATEST IMAGERY USED	NEGATION DATE (if required) NA	

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Installation Name	Coordinates	BE No	COMIREX No	NIETB No
Petropavlovsk HF Communications Facility	53-13N 158-30E			

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ABSTRACT

This report presents a detailed description of Khutor ESV Tracking Facility and Krug Facility 2 (Khutor ESV Tracking Station A). It includes a functional analysis, mensuration, and photography of the installation.

Khutor ESV Tracking Facility is one of a network of ten facilities that provide command and control for Soviet near space (orbital) events, and one of five facilities equipped to provide command and control for the Molniya communications satellite program.

Tracking and telemetry arrays and equipment present at Khutor are, with few exceptions, typical of those observed at other earth satellite vehicle (ESV) and space tracking facilities in the Soviet Union.

Khutor HF Communications Facility, Transmitting (Petropavlovsk HF Communications Facility) is located in the vicinity of the ESV tracking facility. It is discussed in this report because it can be related to one of the two ESV-associated HF receiving communications facilities by the similarity in antenna azimuths. Consequently, there is a possibility that it may be passing tracking data.

INTRODUCTION

Khutor Earth Satellite Vehicle (ESV) Tracking Facility and Krug Facility 2 is 3.2 nautical miles (nm) south of Khutor and 12 nm west-northwest of Petropavlovsk/Kamchatskiy, at an elevation of approximately 50 feet above mean sea level. The installation (Figure 1) is on gently rolling terrain that rises out of the flood plain of the Avacha river. The area is covered by a dense growth of coniferous vegetation; however, the vegetation does not appear to mask the radar line-of-sight.

The installation was first observed on photography in [] at which time the interferometer, the western high frequency (HF) communications facility (receiving), and some unidentified facilities in the main operations area were observed.¹ Since the initial coverage, the installation has been developed into two distinct operations areas: the Molniya operations area and the Flim Flam operations area. Other facilities associated with the enlarged mission of the installation have also been added. These include a large support area collocated with the operations areas, an eastern HF communications facility (receiving), and the Khutor HF Communications Facility, Transmitting. The HF transmitting facility 10 nm to the north-northwest of the installation may be passing tracking data. The availability of high-resolution photography since [] has made possible the identification of all observed tracking and telemetry antennas in the operations areas, and the functional identification of a number of buildings in the support area. Significant operational components now at Khutor include two Flim Flam antennas, two Molniya antennas, three SHIP WHEEL radars, and numerous helical telemetry antennas of various configurations.

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The Molniya operations area occupies approximately 31.5 acres, the secured Flim Flam operations area approximately 57.3 acres, and the centrally located partially secured support area approximately 100 acres.

TOP SECRET

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RCA-03/0037/69

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BASIC DESCRIPTION

Physical Features

Molniya Operations Area

The largest individual electronics components in the Molniya operations area (Figure 2 and Table 1) are the two Molniya communications satellite command and control buildings (items 3 and 21a). These buildings, spaced approximately 600 feet apart, measure []

[] x-y mounted parabolic dish antenna is on a pedestal in the center of each building. Although the basic dish configuration and size appear to be identical for both antennas, current high-resolution photography indicates differences in the feed and secondary reflector structures. The eastern Molniya antenna has a tripod-mounted hyperbolic subreflector centered over a feed structure projecting through the primary reflector. The feed structure of the western antenna is significantly larger in diameter and height. There is a small dish antenna mounted over the subreflector. This antenna provides the initial acquisition of the satellite, which is needed to align the two [] parabolic dishes.²

Two cable connected Molniya-associated antennas with [] parabolic dish reflectors (items 5 and 19) are each on a ground-level mount next to the Molniya control buildings. The western antenna is adjacent to a large control building (item 4) which is contiguous to the Molniya control building. A small control van (item 20) is between the eastern antenna and the Molniya control building. Antennas of this type were previously present at the other four Molniya facilities in the USSR in the same configuration as at Khutor, but only Yeniseysk has one remaining in its original configuration. Near the western [] antenna are two probable optical or instrumentation towers (items 2 and 7). The two towers are each [] high. An unidentified mast, possibly mounting a very high frequency/ultra high frequency (VHF/UHF) antenna array, is probably connected by cables to the [] antenna control building.

Various types of electronics components are present in the Molniya operations area. The following telemetry arrays are connected by cable to a telemetry control building (item 11): one Type I five-element helical array (item 14) one Type II five-element helical array (item 12), one four-element helical array (item 17), and one probable four-element helical array (item 15). An unoccupied antenna pedestal (item 13) is connected by cables to another telemetry control building (item 10). One 16-element helical array and one unoccupied antenna pedestal are connected by cables to each other and to the telemetry control building (item 29). Two 12-element helical arrays are interconnected by cables and also to the telemetry control building (item 25). A mast, [] high, supporting an unidentified VHF/UHF Yagi array is between the easternmost 12-element helical array and the 16-element helical array. An unoccupied antenna pedestal is near the western 12-element helical array. A mast-mounted probable R-400 microwave antenna is immediately west of the control building serving the 12-element helical arrays. A probable optical facility in the southwestern corner of the Molniya operations area consists of a [] probable instrument building with an attached platform measuring [] [] A control building is connected by cables to the instrumentation buildings. Two instrumentation and calibration towers probably serve the Molniya operations area.

Flim Flam Operations Area

The ESV (Flim Flam) operations area (Figure 3 and Table 2) contains two buildings measuring [] located approximately 315 feet apart (items 19 and 20). A dome, [] in diameter, is positioned on the center of the roof of each building. During the construction phase, there were a few occasions when the Flim Flam buildings and their antennas appeared to be externally complete except for emplacement of the dome over the antenna. The Flim Flam antenna, on an azimuth-elevation mount, is a parabolic dish approximately [] in diameter.³

Various other types of electronics components are present in the Flim Flam operations area (Figure 3). Included are three building-mounted SHIP WHEEL radars and a telemetry control building with five antenna platforms, one on each of the four corners

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TOP SECRET

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TOP SECRET

RCA-03/0037/69

Table 1. Molniya Operations Area (item numbers keyed to Figure 2)

Item	Description	Dimensions (ft)		
		L	W	H
1	Support building			25X1
2	Probable optical or instrumentation tower			
3a	Molniya command and control building			
3b	Antenna			
4	Control building			
5	Molniya-associated antenna			
6	Possible VHF/UHF array			
7	Probable optical or instrumentation tower			
8	Support building			
9	Calibration and equipment tower platform			
10	Telemetry control building			
11	Telemetry control building			
12	Type II 5-element helical antenna			
13	Unoccupied antenna pedestal			
14	Type I 5-element helical antenna			
15	Probable 4-element helical antenna platform			
16	Support building			
17	4-element helical antenna Platform			
	Elements			
18	Calibration and equipment tower			
19	Molniya-associated antenna			
20	Control van			
21a	Molniya command and control building			
21b	Antenna			
22	Probable optical instrumentation building			
23	Control building			
24	Probable R-400 microwave antenna			
25a	Telemetry control building			
25b	Section			
26	Support building			
27	12-element helical antenna ground plane			
28	Unoccupied antenna pedestal			
29a	Telemetry control building			
29b	Section			
30	Unoccupied antenna pedestal			
31	12-element helical antenna Ground plane			
32	Possible VHF/UHF ARRAY			
33	16-element helical antenna Ground plane			
34a	Heat and powerplant			
34b	Section			
35	Support building			
36a	Support building			25X1
36b	Section			
37	Support building			

TOP SECRET

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RCA-03/0037/69

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Table 2. Flim Flam Operations Area (item numbers keyed to Figure 3)

BUILDINGS

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Item		Description	Dimensions (ft)			Item		Description	Dimensions (ft)		
			L	W	H				L	W	H
1		Storage building				41		Telemetry control building			
2		Storage building				42		Stacked VHF/UHF Yagi array			
3		Storage building				43		Control building			
4		Cooling tower				44		Unoccupied antenna pedestal			
5		Heat and powerplant				45		Support building			
6		Calibration/equipment tower				46		Building uncon			
7		Support building				47		Three-section prob telemetry array			
8		Interferometer (inoperative)						Circular track			
9		Powerplant				48		Transmitter building			
10		Support building				a		Vertical dipole			
11		Support building				b		Vertical dipole			
12		Support building				c		Vertical dipole			
13		SHIP WHEEL radar on building				d		Vertical dipole			
14		SHIP WHEEL radar on building				e		Vertical dipole			
15		SHIP WHEEL radar on building				49		Calibration/equipment tower			
16		Probable control building uncon				50		Control building			
17		Telemetry control building				51		Prob microwave tower			
18		4-element helix roof-mounted				61		UHF/VHF array			
19		Control building				ANTENNAS					
20		Flim Flam building dome				Item	Type	Soviet Designation	Frequency Range MHZ	Initial Great Circle Bearing (in degs)	
21		Flim Flam building dome				52	Rhombic	RG 64 4.5 1	7.5-14		
22		Support building				53	Rhombic	RG 64 4.5 1	7.5-14		
23		UHF/VHF array				54	Rhombic	RG 64 4.5 1	7.5-14		
24		Support building				55	Rhombic	RG 64 4.5 1	7.5-14		
25		UHF/VHF array				56	Rhombic	RG 64 4.5 1	7.5-14		
26		Probable control bldg				57	Rhombic	RG 64 4.5 1	7.5-14		
27		Support building				58	Rhombic	RG 64 4.5 1	7.5-14		
28		Support building				59	Rhombic (partially dismantled)	Undet	Undet		
29		Calibration and equipment tower				60	Rhombic	RG 64 4.5 1	7.5-14		
30		Support building				62	Horizontal dipole	VGD 25 U	3-7.5		
31		Support building									
32		Support building									
33		UHF/VHF array									
34		Support building									
35		Support building									
36		Support building									
37		Telemetry control bldg with 5 antenna platforms									
38		Support building									
39		Transmitter building									
40		16-element helical antenna (ground plane)									

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TOP SECRET

RCA-03/0037/69

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Table 3. Support Area (item numbers keyed to Figure 4)

Item	Possible Function	Dimensions (ft)			Item	Possible Function	Dimensions (ft)		
		L	W	H			L	W	H
1	Apartment building				57	Administration building			
2	Apartment building				58	Administration building			
3	Support building				59	Living quarters			
4	Support building ucon				60	Living quarters			
5a	Support building ucon				61	Living quarters			
b	Support building ucon				62	Support building			
c	Support building ucon				63	Support building			
6a	Support building				64	Support building			
b	Support building				65	Support building			
7	Support building				66	Support building			
8	Support building				67a	Support building			
9	Heat and steam plant				b	Section			
10a	Support building				68	Living quarters			
b	Support building				69	Support building			
11	Heat and steam plant				70	Support building			
12	Support building				71	Support building			
13	Support building				72	Administration building			
14	Apartment building				73a	Administration building			
15	Apartment building				b	Section			
16	Apartment building				c	Section			
17	Apartment building				74	Living quarters			
18a	Service center				75	Living quarters			
b	Section				76	Living quarters			
19	Support building				77	Administration building			
20	Support building				78a	Administration building			
21	Support building				b	Section			
22	Living quarters				79	Living quarters			
23	Living quarters				80	Support building			
24	Support building				81	Support building			
25	Living quarters				82	Support building			
26	Living quarters				83	Support building			
27	Living quarters				84	Support building			
28	Living quarters				85	Support building			
29	Living quarters				86a	Support building			
30	Living quarters				b	Section			
31	Living quarters				87a	Support building			
32	Living quarters				b	Section			
33a	Living quarters				88	Support building			
b	Section				89	Support building			
34	Support building				90	Support building			
35	Support building				91	Support building			
36	Support building				92	Support building			
37	Support building				93	Support building			
38	Cooling tower				94a	Support building			
39a	Heat and steam plant				b	Section			
b	Section				c	Section			
40	Living quarters				95a	Support building			
41	Support building				b	Section			
42	Living quarters				c	Section			
43	Support building				96	Support building			
44	Support building				97	Support building			
45a	Support building				98	Support building			
b	Section				99	Support building			
46	Support building				100	Support building			
47a	Support building				101	Support building			
b	Section				102	Support building			
48	Support building				103	Support building			
49	Support building				104	Support building			
50a	Support building				105	Support building			
b	Section				106	Support building			
51	Support building				107	Support building			
52a	Administration building				108	Support building			
b	Section				109	Support building			
53	Administration building				110	Support building			
54a	Administration building				111	Support building			
b	Section				112	Support building			
55	Support building				113	Support building			
56	Support building				114	Support building			

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TOP SECRET

RCA-03/0037/69

Table 4. Khutor HF Communications Facility, Transmitting (item numbers keyed to Figure 5)

ANTENNAS					STRUCTURES		
Item	Description	Soviet Designation	Range (MHz)	Initial Great Circle Bearing (in dogs)	Item	Description	Dimensions (ft) L W H
1	Rhombic	RG 64 .8	11.2-21.0		34	R-400 microwave tower	
2	Rhombic, night	RG 64 1	6.7-12.6		35	Watertower	
3	Rhombic, day	RG 67 1	13.3-27.0		36	Living quarters	
4	Double rhombic, day	RGD 64 1.2	14.8-27.7		37a	Support building	
5	Double rhombic, night	RGD 64 .1	7.5-14.0		37b	Section	
6	Double rhombic, day	RGD 64 1.2P	15-28		38	Support building	
7	Double rhombic, night	RGD 64 1.2P	8-15		39	Living quarters	
8	Double rhombic, night	RGD 64 1.2P	8-15		40	Living quarters	
9	Double rhombic, day	RGD 69 1.8	15-28.6		41a	Support building	
10	Double rhombic, night	RGD 64 1.2	8-15		41b	Section	
11	Double rhombic, night	RGD 64 1.2	8-15		42	Support building	
12	Double rhombic, day	RGD 69 1.8	15-28.6		43	Support building	
13	Double rhombic, day	RGD 69 1.8P	15-28.6		44	Building	
14	Double rhombic, night	RGD 64 1.2P	8-15		45	Building	
15	Double rhombic, night	RGD 64 1.2	8-15		46	Building	
16	Double rhombic, day	RGD 69 1.8	15-28.6		47	Building	
17	Double rhombic, night	RGD 64 1.2P	8-15		48	Building	
18	Double rhombic, day	RGD 69 1.8P	15-28.6		49	Building	
19	Double rhombic, night	RGD 64 1.2P	8-15		50	Living quarters	
20	Double rhombic, day	RGD 69 1.8	15-28.6		51	Building	
21	Double rhombic, night	RGD 64 1P	7.5-14.0		52	Poss living quarters	
22	Double rhombic, day	RGD 64 .8P	11.3-21.3		53	Support building	
23	Double rhombic, day	RGD 64 .8	11.3-21.3		54	Support building	
24	Double rhombic, night	RGD 64 1	7.5-14.0		55	Cooling tower	
25	Double rhombic, night	RG 64 .8	7.5-14.0		56a	Transmitter bldg	
26	Double rhombic, day	RG 64 .8	11.2-21.0		b	Section	
27	Quadrant, night	UGD 27 undet	9.38-15.95		57	Support building	
28	Quadrant, day	UGD 15 undet	14-23.8		58	Support building	
29	Quadrant, night	UGD 27 undet	9.38-15.95		59a	Support building	
30	Quadrant, day	UGD 15 undet	14-23.8		59b	Section	
31	Horizontal dipole, day	VGD 30 undet	5-12.5		60	Support building	
32	Horizontal dipole, night	VGD 50 undet	1.87-7.5		61	Support building	
33	Quadrant	VGD 27 undet	9.38-15.95		62	Support building	
					63	Support building	
					64	Power plant	
					65	Support building	
					66	Cooling tower	
					67a	Transmitter building	
					67b	Section	
					68	Control building	

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TOP SECRET

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TOP SECRET

RCA-03/0037/69

Table 5. Eastern HF Communications Facility, Receiving (item numbers keyed to Figure 6)

Antennas

Item	Description	Soviet Designation	Range (MHz)	Initial Great Circle Bearing (in degrees)
1	Fishbone	BS <u>21</u> <u>R</u> 8 4.4H	4.28-21.4	
2	Fishbone	"	"	
3	Fishbone	"	"	
4	Fishbone	"	"	
5	Fishbone	"	"	
6	Fishbone	"	"	
7-9	Quadrant	UGD <u>34</u> H	3.5-6	
10	Quadrant	UGD <u>10</u> H	14-23.8	
11	Horizontal dipole, night	VGD <u>60</u> H	2.5-6.25	
12	Horizontal dipole, day	VGD <u>30</u> H	5-12.5	
13	FORK REST	--	--	
14-21	VHF/UHF arrays	--	--	
22	R-400 microwave with two dishes			

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Buildings

Item	Description	Dimensions (ft) L W H
23	Support building	
24	Support building	
25	Support building	
26a	Heat and power plant	
b	Section	
27	Support building	
28	Support building	
29	Operations and control building	
30	Support building	
31a	Support building	
b	Section	
32	Receiving building	

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TOP SECRET

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TOP SECRET

RCA-03/0037/69

Table 6. Western HF Communications Facility, Receiving
(item numbers keyed to Figure 7)

ANTENNAS

Item	Description	Soviet Designation	Range (MHz)	Initial Great Circle Bearing (In Degrees)
1	Double rhombic, day	RSD 64.5 1 4 1.4	9.6-32	
2	Double rhombic, night	RSD 64.5 1 4 1.5	5.6-18.8	
3	Double rhombic, day	RSD 64.5 1 4 1.4	9.6-32	
4	Double rhombic, night	RSD 64.5 1 4 1.5	5.6-18.8	
5	Fishbone	BS2 21 R 8 4.4 HP	4.28-21.4	
6	Fishbone	"	"	
7	Fishbone	BS2 21 R 8 4.4 H	4.28-21.4	
8	Fishbone	"	"	
9	Fishbone	BS2 21 R 8 4.4 HP	4.28-21.4	
10	Fishbone	"	"	
11	Fishbone	BS2 21 R 8 4.4 H	4.28-21.4	
12	Fishbone	"	"	
13	Fishbone	BS2 21 R 8 4.4 HP	4.28-21.4	
14	Fishbone	BS2 21 R 8 4.4 H	4.28-21.4	
15	Fishbone	"	"	
16	Quadrant, night	UGD 28 H	4-6.8	
17	Quadrant, day	UGD 15 H	9.38-15.95	
18	Quadrant, night	UGD 28 H	4-6.8	
19	Quadrant, day	UGD 15 H	9.38-15.95	
20	Quadrant, day	UGD 15 H	9.38-15.95	
21	Quadrant, night	UGD 28 H	4-6.8	
22	Horizontal dipole	VGD 30	5-12.5	

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BUILDINGS

Item	Description	Dimensions (ft) L W H
23	Receiving building	
24	Support building	
25	Support building	
26	Support building	

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RCA-03/0037/69

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and on the center of the roof of the building. The four corner platforms appear to support small helical arrays and the center platform possibly supports a single-element helical array. Also present in the area are a 16-element helical array which is connected by cables to an unoccupied antenna pedestal and a telemetry control building, a stacked VHF/UHF Yagi array adjacent to a telemetry control building, a three-section probable telemetry array which rotates on a circular track and pivots in the center, an additional possible telemetry building with an unidentified antenna mounted on the southwestern corner of the roof, one HF communications facility containing a transmitting and control building with eight rhombic antennas on the southern side of the Flim Flam operations area, several probable Yagi arrays and a horizontal dipole antenna, one roof-mounted four-element helical array (item 17), a probable R-400 microwave tower and control building, and, at the western end of the secured operations area, a transmitter building surrounded by five vertical dipole antennas, each connected by cables to the building. The building with the five vertical antennas is probably the same type of VHF communications component present at most of the Soviet ESV tracking facilities. Several calibration and equipment towers are also within the operations area. The interferometer on the northwestern side of the operations area is probably inoperative or abandoned.

Support Area

The support area (Figure 4 and Table 3), between the Molniya and the Flim Flam operations areas, occupies approximately 100 acres and contains 114 significant buildings. There is no apparent security around the overall area; however, some sections within the area are fenced.

Communications Facilities

The Khutor HF Communications Facility, Transmitting (Figure 5 and Table 4) is approximately 10 nm north-northeast of the Khutor ESV Tracking Facility. This transmitting facility can be related to the western HF communications facility (receiving) at the ESV tracking facility by the similarity in antenna azimuths. However, the eastern HF communications facility (receiving) does not appear to be related to the Khutor HF Communications Facility, Transmitting. The antenna characteristics for the eastern and western HF communications facilities are shown in Tables 5 and 6, keyed to Figures 6 and 7. An R-400 microwave communications system probably interconnects all major components of the ESV tracking facility. Interpretability of available photography precludes determination of the antenna azimuths.

A cable installed in [] appears to extend from the Molniya terminal to Petropavlovsk/Kamchatskiy where it probably terminates in a TV station.²

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The Krug site support facilities are probably in the ESV Tracking Facility support area; however, Krug 2 is not directly related to the functions of the ESV Tracking Facility.

Chronology, Status and Activity

On initial photographic coverage of the facility in [] an interferometer, a Krug antenna, and the western HF communications facility were the only significant facilities identified. The next available photography of the facility, in [] revealed the presence of the Flim Flam tracking facility, the Molniya facility, and the eastern HF communications facility which was then under construction. In early [] the dome was present over the Flim Flam antenna (item 19, Figure 3) and the two [] diameter antennas associated with the Molniya system were present. The 50-foot-diameter antennas were placed on the Molniya buildings by [] thus externally completing the facility. In [] the dome was placed over the other Flim Flam antenna (item 20, Figure 3). Construction was also in progress on a number of large buildings in the area.

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From the latter part of [] through [] no major construction was noted. From [] to date, several large buildings have been constructed. Construction activity has continued through []

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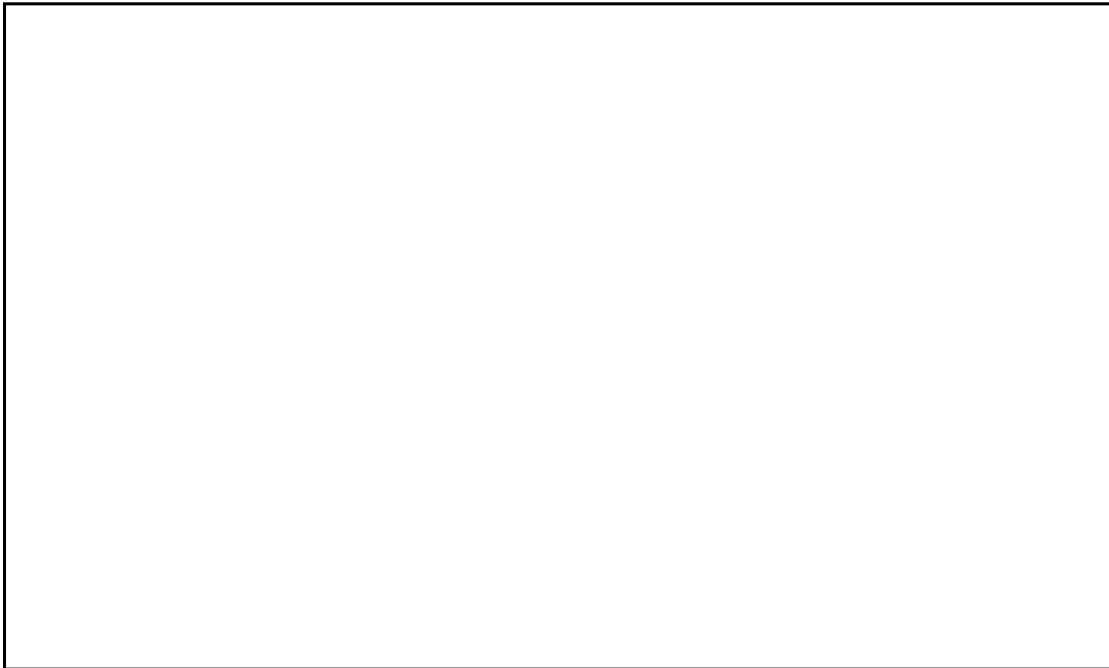
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Operational Functions

Functional responsibilities of the Khutor ESV Tracking Facility cover a broad range. The principal components indicate that the primary missions are to support Soviet near-space events, to provide command and control, and to serve as a ground terminal and relay for the Molniya "Comsat" system. The facility could, and may, provide support to ICBM missile firings from Tyuratam to Kamachatka. Equipment at Khutor could also receive telemetry, determine the location of a vehicle, and provide command and control as necessary.

REFERENCES

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MAPS OR CHARTS

ACIC. US Air Target Chart 200, Sheet M0194-17HL, 4th ed, Apr 65, scale 1:200,000 (SECRET/

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DOCUMENTS

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